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(NASA-TM-87440) DOCUMENTATION FOR THE
MACHINE-READABLE VERSION OF A FINDING LIST
FOR THE MULTISET TABLES OF NSRDS-NES 3,
SECTIONS 1-10 (ADELMAN, ADELMAN, FISCHEL AND
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OF

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(ADELMAN, ADELMAN, FISCHEL AND WARREN 1984)



DECEMBER 1984

DOCUMENTATION FOR THE MACHINE-READABLE VERSION
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(ADELMAN, ADELMAN, FISCHEL AND WARREN 1984)

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ABSTRACT

A detailed description of the machine-readable finding list, as it is currently being distributed from the Astronomical Data Center, is presented. This version of the list supersedes an earlier one (1977) containing only Sections 1-7 of the *NSRDS-NBS 3* multiplet tables publications. Additional sections will be incorporated into this list as they are published.

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SECTION 1 - INTRODUCTION AND SOURCE REFERENCES

The primary references for stellar line identifications in the optical and ultraviolet spectral regions have been *A Multiplet Table of Astrophysical Interest* (RMT, Moore 1945) and *An Ultraviolet Multiplet Table* (UMT, Moore 1950, 1952, 1962). Dr. Charlotte Moore Sitterly has, over the last two decades, undertaken a revision of certain multiplet tables based on data derived from analyses of optical spectra. The present finding list has been prepared from the data published in the first ten sections of these revised tables. Table 1 gives relevant information for these publications.

Table 1. NSRDS-NBS, Sections 1-10 Information.

<u>Section</u>	<u>Year</u>	<u>Spectra</u>
1	1965	Si II, Si III, Si IV
2	1967	Si I
3	1970	C I, C II, C III, C IV, C V, C VI
4	1970	N IV, N V, N VI, N VII
5	1975	N I, N II, N III
6	1972	H I, D I, T I
7	1976	O I
8	1979	O VI, O VII, O VIII
9	1980	O V
10	1983	O IV

An earlier finding list containing Sections 1-7 only was published by Adelman, Adelman and Fischel (1977). We have revised the format and added information to the earlier list, and have appended Sections 8-10 to produce the present version. We intend to incorporate future sections to produce new comprehensive lists as the sections are published and can be computerized.

This document describes the machine version of the finding list as it is currently being distributed from the Astronomical Data Center. It is intended to enable users to read and process the data without problems and guesswork, and to interpret the various codes used in the list without recourse to the original publications. However, for additional details concerning the multiplet tables and analyses of the optical spectra, the source publications and their associated references should be consulted. A copy of this document should accompany any machine version of this finding list originally obtained from the Astronomical Data Center.

SOURCE REFERENCES

Moore, C. E. 1965, 1967, 1970a, 1970b, 1972, 1975, 1976, 1979, 1980, 1983, *Nat. Bur. Stand. Ref. Data System (NSRDS)*, *Nat. Bur. Stand. (NBS)* 3, Sec. 1-10.

SECTION 2 - TAPE CONTENTS

A byte-by-byte description of the contents of the machine-readable finding list is given in Table 2. A suggested Fortran 77-type format specification is included for each data field and can be modified depending upon individual programming and processing requirements; however, caution is advised when substituting format specifications, since some data fields are blank when data are absent. Particular care is required for certain fields where valid zero values can exist, but which can also be blank, e.g., intensities, excitation potentials and J values. Note also that wavelength precision varies so that zeros or blanks can occur in the same bytes to the right of the decimal points. For such fields, primary numerical format specifications are suggested to indicate decimal-point locations, while alternate A-type formats are specified in parentheses. Default (null) values are always blanks in data fields for which primary suggested formats are given as A.

Table 2. Tape Contents. *A Finding List for the Multiplet Tables of NSRDS-NBS 3, Sections 1-10.*

Byte(s)	Units	Suggested Format	Default Value	Remarks
1- 2	---	A2	---	Element.
3- 4	---	I2 (A2)	---	Atomic species number.
5	---	A1	---	A left bracket ([) if the wavelength is enclosed in brackets (indicating that a theoretical value of either or both energy levels of the transition has been used to derive the predicted wavelength; [Moore 1967] in the multiplet table).
6-16	A	F11.4 (A11)	---	Wavelength of the transition. The precision of the numbers varies.
17	---	A1	---	A right bracket (]) if the wavelength is enclosed in brackets (see byte 5).
18	---	A1	---	A code for indication of blending or for miscellaneous information. The codes are defined in Table 3.
19	---	A1	---	Reference for the original analysis. These references are too extensive to be listed in this document and the source publications will need to be consulted if they are required. Users are advised to check the quality of each analysis from which the tables are assembled if

Table 2 (continued)

Byte(s)	Units	Suggested Format	Default Value	Remarks
				uncertainties in identifications are encountered. The same letter codes denote different references in different sections, so the correct section must be consulted. The code "P" indicates a predicted wavelength.
20-33	---	A14	---	Line intensity. Various parts of this data field are uniform, e.g., it is possible to read the numerical intensities if the field is read with format (A3,F6.1,A5) since character data are in all cases separate from numerical intensities. Note, however, that a numerical intensity may be zero or blank, atomic species number may occur in a numerical field if an element is specified in bytes 21-22, and parentheses and asterisks are used to indicate intensity scale changes and that the intensity is affected by that of a neighboring line or an impurity line. Thus, although numerical intensities may be read and tested upon, the overall data field must be considered for correct interpretation.
34-40	eV	F7.2	blank	Lower excitation potential. All limits and energy levels given in cm^{-1} have been multiplied by the factor 0.000123981 to obtain the respective values in electron volts (see Moore 1965).
41-47	eV	F7.2	blank	Higher excitation potential. The comments for bytes 34-40 apply here.
48-50	---	F3.1	blank	Lower J value corresponding to the low level involved in the transition producing the line.
51-53	---	F3.1	blank	Higher J value.
54	---	A1	---	A query (?) if the J values are uncertain (appears in source multiplet tables).

Table 2 (concluded)

Byte(s)	Units	Suggested Format	Default Value	Remarks
55-56	---	A2	---	The letters "UV" when a multiplet occurs shortward of 3000 Å and blank for multiplets longward of 3000 Å (stated in Moore 1965); however, multiplets having $\lambda < 3000$ Å occur throughout the sections without the UV prefix.
57-62	---	F6.2	blank	Multiplet number. Due to the retention of earlier numbers from the <i>RMT</i> and <i>UMT</i> , a dual numbering system consisting of real and integer numbers is used (see Moore 1965, p. vii for a more detailed explanation); however, the integer numbers are aligned so that the F format can be used to read them as real numbers. Newly inserted numbers appear in decimal form, while integer numbers only are used after the old multiplet numbers are exhausted.
63	---	A1	---	An "F" occurs to denote a forbidden transition.
64	---	A1	---	A code to indicate blends of specific lines, ultimate lines, italicized numerical intensities, etc. These codes are defined in Table 4.
65-66	---	I2	---	Section number of the <i>NSRDS-NBS 3</i> publication in which the line appears.
67-70	---	I4	---	Sequential number of the line in the respective multiplet table. The original tables can be reconstructed from the λ ordered finding list by sorting the complete list by section number (primary) and sequential number (secondary).

Table 3 contains definitions for the codes used in byte 18 of certain finding list records. These codes do not always occur in the multiplet tables, e.g., the "D" code, and were added after creation of the finding list. Other codes have been moved to this position from the intensity column in the multiplet tables.

Table 3. Comment Codes for Byte 18 Information.

Code	Meaning
a	Observed members of series shifted to longer waves by 0.309 Å to 0.052 Å (n = 5 to 8) when autoionization is effective.
D	Line deleted in a later publication.
I	Denotes intersystem combinations of astrophysical interest (see Moore 1965, p. vii for further remarks).
m	Indicates that the line is masked. The spectrum of the masked line then appears in the intensity column with element identified in bytes 21-22 and atomic species number in byte 26.
*	The line is blended throughout and has more than one classification in the same spectrum (as opposed to appearance in intensity field, byte 23; see explanation for bytes 20-33).

Table 4 describes the coding used for the information provided in byte 64 of certain records. Most of these codes result from symbols (§) used in the multiplet tables to denote blends when the specific contributors are identified. Where the double dagger (§) appears on wavelength in the multiplet tables, a "U" has been used in byte 64.

Table 4. Comment Codes for Byte 64 Information.

Code	Meaning
A	Blended with Ar I
C	Expanded from single line in multiplet table (multiple J values)
D	Blend of Si III and Si IV
E	Blend of N III and N IV
G	Blend of C I and C II
H	Blend of C II and C III
I	Blend of C III and C IV
J	Blend of C IV and C V
K	Blend of N IV and N V
L	Blend of O IV and Si III
M	Blend of O IV and O V
N	Blend of O III and O V
O	Blend of O II and O V
P	Blend of O VI and O VII
Q	Blend of O VI and Be III
R	Blend of O III and O IV
S	Blend of O II and O IV
U	Ultimate line (<i>raie ultime</i>)
W	Blend of N III and N VI
X	Blend with N II
Y	Blend with O III
Z	Blend with Al II
1	Intensity given in <i>italics</i> (significance not found defined in publications)
2	1 + C

SECTION 3 - TAPE CHARACTERISTICS

The information contained in Table 5 is sufficient for a user to describe the indigenous characteristics of the magnetic tape version of *A Finding List for the Multiplet Tables of NSRDS-NBS 3, Sections 1-10* to a computer. Information which is easily varied from installation to installation, such as block size (physical record length), blocking factor (number of logical records per physical record), total number of blocks, tape density, and coding (EBCDIC, ASCII, etc.) is not included: this information should always be supplied if secondary tape copies of the catalog are transmitted to other users or installations.

Table 5. Tape Characteristics. *A Finding List for the Multiplet Tables of NSRDS-NBS 3, Sections 1-10.*

NUMBER OF FILES	1
LOGICAL RECORD LENGTH (BYTES)	70
RECORD FORMAT	FB*
TOTAL NUMBER OF LOGICAL RECORDS	9969

* Fixed block length (last block may be short)

SECTION 4 - REMARKS AND REFERENCES

Sections 1-7 of the finding list (Adelman, Adelman and Fischel 1977) were available on magnetic tape. The multiplet tables of sections 8-10 were transcribed to data sheets at The Citadel by CJA and SJA, and transferred to disk storage at the ADC by WHW. A format was then designed to accommodate the data of all sections and the differing formats of both groups were changed to the new format. The individual sections were then broken out of the groups for checking. Corrections were made and detailed checks of the original publications performed, the format being revised several times to allow for additional information and to effect homogeneity in the data presentation. Groups of lines which had been added in Sections 1-7 without resequencing were moved to their correct locations and all sections were resequenced to be certain that a sequence sort will recover the original tables exactly. The individual sections were then combined and the complete file sorted by wavelength with secondary sorting on sequence number.

REFERENCES

- Adelman, C. J., Adelman, S. J. and Fischel, D. 1977, *NASA X-685-77-287*.
- Moore, C. E. 1945, *A Multiplet Table of Astrophysical Interest, Princeton Obs. Contribution No. 20* (reprinted 1959, *Nat. Bur. Stand. Technical Note 36*).
- Moore, C. E. 1950, 1952, 1962, *An Ultraviolet Multiplet Table, Nat. Bur. Stand. Circular 488, Sec. 1-5*.
- Moore, C. E. 1965, 1967, 1970a, 1970b, 1972, 1975, 1976, 1979, 1980, 1983, *Nat. Bur. Stand. Ref. Data System (NSRDS), Nat. Bur. Stand. (NBS) 3, Sec. 1-10*.

SECTION 5 - SAMPLE LISTING

The sample listing given on the following pages contains logical data records exactly as they are recorded on the tape. Groups of records from the beginning and end of the finding list are illustrated. The beginning of each record and bytes within the record are indicated by the column heading index across the top of each page (digits read vertically).

